1. List the four main sources of drug products.
   Plant; Animal; Minerals; Synthetic (Chemicals)
2. Describe how drugs are classified.
   Utilizes a number and a letter for each new drug.
   Numerical Classification (Chemical)
   Assigned a number 1-7
   Letter Classification (Treatment or Therapeutic Potential)
   Other Classifications
3. List the authoritative sources for drug information.
   American Medical Association (AMA) Drug Evaluation; Hospital Formulary; Medication package inserts; Physician's Desk Reference (PDR)
4. List legislative acts controlling drug use and abuse in the United States.
   a. The Pure Food & Drug Act of 1906
      i. Enacted to improve the quality and labeling of drugs.
   b. Harrison Narcotic Act of 1914
      i. Limited the indiscriminant use of addicting drugs by regulating the importation, manufacture, sale, and use of opium, cocaine, and their compounds or derivatives.
   c. The Federal Food, Drug and Cosmetic Act of 1938.
      i. Empowered the FDA to pre-market safety standards for drugs. Amended in 1951 by the *Durham-Humphrey Amendments* to require written or verbal prescriptions from a physician to dispense certain drugs.
   d. Comprehensive Drug Abuse Prevention and Control Act. Of 1970. (AKA Controlled Substances Act.
      i. Most recent major federal legislation affecting drug sale and use. Replaced the Harrison Narcotic Act of 1914
5. Differentiate among Schedule I, II, III, IV, and V substances.
   e. Schedule I
      i. High abuse potential. No accepted medical indications. Examples: Heroin, LSD
   f. Schedule II
      i. High abuse potential. Accepted medical indications Examples: Opium, cocaine.
   g. Schedule III
      i. Less abuse potential than schedule II or II; may lead to moderate or low physical dependence.
      ii. Limited opioid amount or combined with non-controlled substances.
         1. Examples: Vicodin, Tylenol w/ codeine.
   h. Schedule IV
      i. Low abuse potential compared to schedule III. Limited psychosocial and/or physical dependence. Examples: Diazepam, lorazepam, phenobarbital.

i. Schedule V
    i. Lower abuse potential than schedule IV. May lead to psychosocial and/or physical dependence.Limited amounts opioids; often for cough or diarrhea.

6. Discuss special consideration in drug treatment with regard to pregnant, pediatric, and geriatric patients.

Pediatric Patients

ii. Neonates (Infants from birth to 4 weeks) metabolism and excretion may be impaired.
iii. Children up to one year have diminished plasma protein concentrations.
iv. Results in higher free drug availability with drugs that bind to proteins.
v. Many factors cause a pediatrics drug function to differ radically from an adults.

j. Geriatric Patients
    i. Common physiological effects of aging:
        1. Decreased cardiac output
        2. Decreased renal function
        3. Decreased brain mass
        4. Decreased total body water
        5. Decreased body fat
        6. Decreased serum albumin
        7. Decreased respiratory capacity
    ii. These changes can lead to:
        1. Altered pharmacodynamics & pharmacokinetics.
        2. Decreased rates of metabolism and excretion.
        3. Decreased protein binding because of decrease level of serum albumin.
    iii. Result – Dosages may have to be decreased.
    iv. Elderly also suffer from multiple disease processes.
    v. May be on chronic medications that can affect emergency medications.

k. Pregnant Patients
    i. Anatomical & Physiological changes.
        1. Increased cardiac output
        2. Increased heart rate
        3. Increased blood volume (up to 45%)
        4. Decreased protein binding
        5. Decreased hepatic metabolism
        6. Decreased blood pressure
    ii. Drug has the potential to cross the placenta and affect the fetus.
    iii. Drug therapy can affect a breast-feeding infant.

7. Discuss the paramedic's responsibilities and scope of management pertinent to the administration of medications.

l. Paramedics are personally, legally, morally and ethically responsible for the safe administration of medications.
    i. Know the precautions and contraindications for all medications you administer.
    ii. Practice proper technique.
    iii. Know how to observe and document drug effects.
    iv. Maintain a current knowledge in Pharmacology.
    v. Establish and maintain professional relationships with other health care providers.
    vi. Understand the pharmacokinetics and pharmacodynamics.
    vii. Have current medication references available.
    viii. Take careful drug histories including:
        1. Name, strength, and daily dose of prescribed drugs
        2. Over-the-counter drugs
        3. Vitamins
        4. Herbal medications; Folk-medicine or folk remedies
        5. Allergies
    ix. Evaluate the compliance, dosage, and adverse reactions.
    x. Consult with medical direction when appropriate

8. Describe general properties of drugs.
9. Describe mechanisms of drug action.
10. Differentiate the phases of drug activity, including the pharmaceutical, pharmacokinetic, and pharmacodynamic phases.

m. Pharmacokinetics

i. Strictly defined, pharmacokinetics is the study of the basic processes that determine the duration and intensity of a drug's effect.
ii. Pharmacokinetic Processes
iii. Absorption
iv. Distribution
v. Biotransformation
vi. Elimination

n. Physiology of Transport
    i. Active transport
    ii. Carrier mediated diffusion,
        1. AKA facilitated diffusion
    iii. Passive transport
    iv. Diffusion
    v. Osmosis
    vi. Filtration

o. Absorption
    i. The process of movement of a drug from the site of application into the body and into the extra-cellular compartment.
        1. Affected by many factors including:
            a. Solubility of the drug

b. Concentration of the drug
c. pH of the drug (Actually the pH of the patient has more to do with this.)
d. Site of absorption
e. Absorbing surface area
f. Blood supply to the supply to the site of absorption
g. Bioavailability
    i. Comparison of Rates of Drug Absorption of Various Routes of Administration

p. Distribution
    i. The process whereby a drug is transported from the site of absorption to the site of action.
        1. Affected by several factors:
            a. Cardiovascular function
            b. Regional blood flow
            c. Drug storage reservoirs
            d. Physiological barriers
            e. blood-brain barrier
            f. Placental barrier

q. Biotransformation
    i. A special name for metabolism.
    ii. Metabolism
    iii. Has one of two effects on drugs.
        1. It can transform the drug into a more or less active metabolite.
        2. It can make the drug more water soluble (or less lipid soluble) to facilitate elimination.
    iv. Biotransformation process:takes place in:
        1. The liver.
        2. Microsomal enzymes in the endoplasmic reticula of hepatocytes (liver cells).
        3. Kidney Lung and GI tract
    v. First-pass effect.
        1. Blood supply from the GI Tract passes through the liver before moving on through the systemic circulation.
        2. First pass may completely inactivate many drugs.
        3. These drugs must be given IV rather than orally.
    vi. Biotransformation begins immediately following introduction of the drug.
        1. Certain drugs are rapidly transformed.
        2. Epinephrine is active as administered and rapidly metabolized to inactive forms.

vii. The livers microsomal enzymes react with drugs in two ways:
    1. Phase-I (non-synthetic reactions.)
        a. Most often oxidize the parent drug.
        b. May reduce or hydrolyze the drug.
    2. Phase II (synthetic reactions.)
        a. AKA conjugation reactions, combine the prodrug or its metabolites with an endogenous chemical, usually making the drug more polar and easier to excrete.

r. Elimination
    i. Refers to movement of a drug or its metabolites from the tissues back into the circulation and to the organs of excretion.
    ii. Eliminated in original form or as metabolites.
    iii. Elimination is affected by:
        1. Drug half-life
        2. Accumulation.
        3. Clearance

s. Onset, peak, and duration.

t. Drug Routes
    i. Enteral.
        1. Enteral Routes
            a. Oral (PO)
            b. Orogastric / nasogastric tube (OG/NG)
            c. Sublingual (SL)
            d. Buccal
            e. Rectal (PR)
        2. Advantages
            a. Simple; safe
            b. Generally less expensive
            c. Low potential for infection.
        3. Disadvantages
            a. Slow rate of onset
            b. Cannot be given to unconscious of nauseated patients.
            c. Absorbed dosage may vary significantly because of actions of digestive enzymes and the condition of the intestinal tract.
    ii. Parenteral Routes.
        1. Parenteral Routes
            a. Topical
            b. Intradermal
            c. Subcutaneous
            d. Intramuscular
            e. Intramuscular

f. Intravenous
g. Endotracheal
h. Sublingual injection
i. Intracardiac
j. Intraosseous
k. Inhalation
l. Umbilical
m. Vaginal

u. Drug Forms
   i. Solid
   ii. Pills
   iii. Powders
   iv. Tablets
   v. Suppositories
   vi. Capsules
   vii. Liquid
   viii. Solutions
   ix. Tinctures
   x. Suspensions
   xi. Emulsions
   xii. Spirits
   xiii. Elixirs
   xiv. Syrups

2. Pharmacodynamics

a. Is the study of mechanisms by which specific drug dosages act to produce biochemical or physiological changes in the body.
b. Actions of Drugs
   i. Can act in four different ways:
      1. Bind to a receptor site.
      2. Change the physical properties of cells.
      3. Chemically combine with other chemicals.
      4. Alter a normal metabolic pathway..
   ii. Binding To A Receptor Site
      1. A receptor is a specialized protein that combines with a drug resulting in a biochemical effect.
      2. Affinity
         a. Force of attraction between a drug and a receptor.
      3. Efficacy
         a. A drugs ability to cause the expected response.
   iii. Second messenger:
      1. Chemical that participates in complex cascading reactions that eventually cause a drug's desired effect.
   iv. Down-regulation

1. Binding of a drug or hormone to a target cell receptor that causes the number of receptors to decrease.

v. Up-regulation
   1. A drug causes the formation of more receptors than normal.

vi. Stimulation of A Receptor Site
   1. Chemicals that stimulate fall into two broad categories:
      a. Agonist
         i. Causes it to initiate the expected response.
      b. Antagonist
         i. Causes the drug not to initiate the expected response.
      c. Some drugs do both.
         i. Called agonist-antagonist AKA Partial agonist.
   2. Competitive antagonism:
      a. One drug binds to a receptor and causes the expected effect while also blocking another drug from triggering the same receptor.
   3. Non-Competitive antagonism:
      a. The binding of an antagonist causes a deformity of the binding site that prevents an agonist from fitting and binding.
   4. Irreversible antagonism:
      a. A competitive antagonist permanently binds with a receptor site.

vii. Other Actions of Drugs
   1. Changing Physical Properties:
      a. Osmotic balances across membranes are good examples.
   2. Chemically combining with other substances.
      a. Drugs that participate in chemical reactions that change the chemical nature of their substrates.
   3. Altering a normal metabolic pathway:
      a. The anticipated product will not form of, if formed, will be substantially or completely inactive.

c. Responses to Drug Administration
   i. Side effect
   ii. Allergic reaction
   iii. Idiosyncrasy.
   iv. Tolerance
   v. Cross Tolerance

vi. Tachyphylaxis
vii. Cumulative effect
viii. Drug dependence.
ix. Drug interaction
x. Drug antagonism
xi. Summation
xii. Synergism
xiii. Potentiation
xiv. Interference

d. Drug Response Relationship
    i. Correlates different amounts of drug to the resultant clinical response.
    ii. Plasma-level profile
        1. Describes the lengths of onset, duration, and termination of action, as well as the drug's minimum effective concentration and toxic levels.
    iii. Factors Altering Drug Response
        1. Age
        2. Body Mass
        3. Sex
        4. Environment
        5. Time of Administration
        6. Pathologic state
        7. Genetic factors
        8. Psychological factors

e. Drug Interactions
    i. Variables that may cause drug-drug interactions:
        1. One drug could alter the rate of intestinal absorption.
        2. The two drugs could compete for plasma protein binding, resulting in one's accumulation at the other's expense.
        3. One drug could alter the other's metabolism, thus increasing or decreasing either's bioavailability.
        4. One drug's action at a receptor site may be antagonistic or synergistic to another's.
        5. One drug could alter the other's rate of excretion through the kidneys.
        6. One drug could alter the balance of electrolytes necessary for the other drug's expected result.

11. Assess the pathophysiology of a patient's condition by identifying classifications of drugs.
12. Integrate pathophysiological principles of pharmacology with patient assessment.
13. Synthesize patient history information and assessment findings to form a field impression.

14. Synthesize a field impression to implement a pharmacologic management plan.
15. Discuss the “six rights” of drug administration and correlate these with the principles of medication administration.
16. Describe the indications, equipment needed, techniques used, precautions, and general principles of administering medications by the gastric tube and rectally.
17. Differentiate among the different percutaneous routes of medication administration.
18. Integrate pathophysiological principles of medication administration with patient management.
19. Formulate a pharmacologic management plan for medication administration.